

New records of *Lontra longicaudis* (Olfers, 1818) (Carnivora, Mustelidae) in El Salvador

Guillermo Funes¹, Xochilt Pocasangre-Orellana^{2,3}

1 Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Turrialba, Costa Rica. **2** Fundación Naturaleza El Salvador, Departamento de Investigación, Colonia Escalón, CP 1101, San Salvador, El Salvador. **3** UDP Ciencias Neotropicales, Departamento de Investigación, San Salvador, El Salvador.

Corresponding author: Guillermo Funes, guilleyfunes@gmail.com

Abstract

Lontra longicaudis Olfers, 1818 (Neotropical Otter) has been poorly studied in El Salvador. We report sightings and traces of *L. longicaudis* which were found in Río Angue, in the department of Santa Ana, and Río Sapo, Río Negro, and Quebrada de Perquín, in the department of Morazán. Moreover, we review the sight records of the species in the scientific literature, the mammal collection of the University of California, Los Angeles, and citizen reports with verifiable evidence. This is the first compilation of information on *L. longicaudis* occurrences in El Salvador.

Keywords

Central America, distribution, Neotropical Otter, Río Lempa, Río Sapo.

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Introduction

Neotropical Otter, *Lontra longicaudis* (Olfers, 1818), is a carnivorous mammal of the family Mustelidae with a wide distribution in the Neotropics (Kruuk 2006). It occurs from northwestern Mexico to central Argentina (Larivière 1999; Rheingantz et al. 2014). This species inhabits various freshwater aquatic ecosystems (Parera 1993; Kruuk 2006; Arellano Nicolás et al. 2012) but also occurs in brackish waters (Quadros and Monteiro-Filho 2001; Grajales-García et al. 2019). This mustelid feeds mainly on fish and crustaceans (Sánchez and Aranda 1999; Quadros and Monteiro-Filho 2001; Grajales-García et al. 2019), although its diet may vary depending on the availability of prey (Quadros and Monteiro-Filho 2001; Platt and Rainwater 2011; Rheingantz et al. 2017).

Lontra longicaudis is classified as Near Threatened

by International Union for Conservation of Nature and has been included in Appendix I of the Convention on International Trade in Endangered Species due to illegal hunting for the use of their pelts in some Latin American countries (Parera 1993; Kruuk 2006; Rheingantz and Trinca 2015; de Almeida and Pereira 2017). Furthermore, this species is affected by anthropogenic threats such as habitat fragmentation, frequent road killings, conflicts with artisanal fishing, and pollution of habitat by industrial and urban waste (Reynoso 1997; Rheingantz and Trinca 2015; de Almeida and Pereira 2017; Andrade et al. 2019). In El Salvador, *L. longicaudis* is listed as an endangered species under national legislation (MARN 2015), and its main threats are the contamination of rivers and the drastic reduction of forest cover (MARN 2019).

Currently, the terrestrial protected areas system in El Salvador only covers 8% of its territory (UNEP-WCMC 2020) and in its present form is based on the availability of forest fragments with protection potential and does not consider aspects of connectivity and functionality of ecosystems. Usually, the creation of protected areas under this approach has excluded many rivers and some wetlands (Saunders et al. 2002; Nel et al. 2009). This approach limits the protection of semi-aquatic species, like *L. longicaudis*, which require large extensions of rivers and riparian forests for maintaining stable populations (Rosas 2004) and even limits the protection of large carnivores that demand large extensions of forest (Crespin and García-Villalta 2014). Therefore, an integrated hydrographic basin management approach would generate better conservation outcomes for this species that depends on the connectivity of the river system for its development (Nel et al. 2009; Rheingantz et al. 2014).

Most studies on *L. longicaudis* have been carried out in Argentina, Brazil, Colombia, and Mexico (e.g., Parera 1993; Reynoso 1997; Sánchez and Aranda 1999; Quadros and Monteiro-Filho 2001; Andrade-Ponce and Angarita-Sierra 2017; Pocasangre-Orellana and Spínola-Parallada 2018). In the Central American region, only a few studies report on the distribution (e.g., Chehébar 1990; Aceituno et al. 2015; Rheingantz and Trinca 2015), diet, and habitat selection (Spínola-Parallada and Vaughan-Dickhaut

1995; Platt and Rainwater 2011; Navarro-Picado et al. 2017) of this species. In El Salvador, the presence of this species has been reported in the scientific literature from only five localities: Río Sensunapán, Río Sucio, Río La Palma, and two records in the middle and lower basin in the Río Sapo (Burt and Stirton 1961; Owen et al. 1991; Owen and Girón 2012; Argueta-Rivera et al. 2020), and there are no recent publications on distribution patterns or the conservation status of *L. longicaudis* in the country. Therefore, we document new records of *L. longicaudis* in El Salvador and other data to better determine the distribution patterns of this species in El Salvador. We also discuss research gaps and some aspects of conservation of *L. longicaudis* in El Salvador.

Methods

Two field campaigns were conducted in 2019. The first field campaign was from February to July on Río Angue (municipality of Metapán, department of Santa Ana) in northwestern El Salvador. Río Angue originates in Guatemala and is one of the main tributaries of Lake Güija in El Salvador. This river belongs to the Río Lempa hydrographic region (Fig.1). The characteristic ecosystem of this region is tropical dry forest (Holdridge 1975). The second campaign was from July to December in the department of Morazán in northeastern El Salvador,

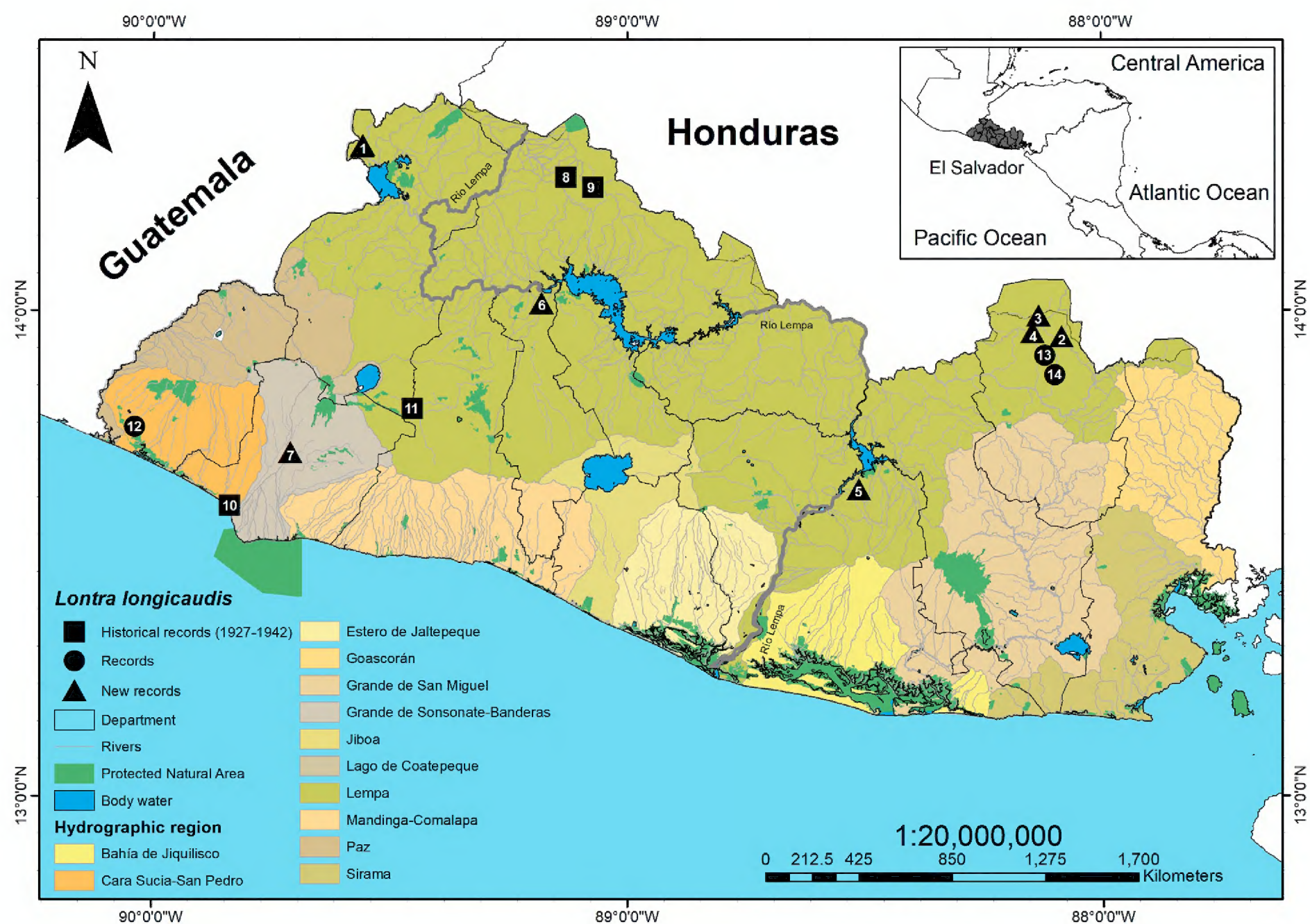


Figure 1. Location of historical and new records of Neotropical Otter (*Lontra longicaudis*) in El Salvador: 1) Río Angue, 2) Río Sapo, 3) Río Negro, 4) Quebrada de Perquín, 5) Estanzuelas, 6) El Paísnal, 7) Río Quequesquillo, 8) Los Esesmiles, 9) Los Esesmiles, 10) Río Sensunapán, 11) Río Sucio, 12) Río La Palma, 13) Río Sapo (middle basin), and 14) Río Sapo (low basin).

where three localities were studied: Río Sapo (municipality of Arambala), Río Negro (municipality of Perquín), and Quebrada de Perquín (municipality of Perquín); the latter two localities are near the border with Honduras. These three rivers are connected to the Río Torola basin which belongs to the Río Lempa hydrographic region (Fig. 1). In these sites, the predominant vegetation in the landscape is pine–oak. In all rivers sampled, the water quality is good and human disturbance is low (MARN 2019). In both field campaigns we looked for direct or indirect signs of otter presence (feces, tracks, and dens). We used a camera, binoculars, and a GPS receiver for data collection. We walked the same, approximately 5 km stretch of the Río Angue five days per month (total effort of 25 days). For each of the other rivers (Río Sapo, Río Negro, and Quebrada de Perquín), we walked the same, approximately 3 km stretch two days per month (total effort of 10 days per river).

We reviewed all available reports of *L. longicaudis* in El Salvador from scientific publications, government reports, and citizen reports with verifiable evidence. We also consulted the mammal collection of the University of California, Los Angeles (UCLA) and of the Museum of Vertebrate Zoology (MVZ), University of California, Berkeley, which have collections from El Salvador. Finally, we compared distributional data of *L. longicaudis* with the hydrographic regions of El Salvador to determine information gaps using these regions as a unit of study and reviewed records from near protected natural areas using ArcGIS v. 10.5 (ESRI 2017).

Results

Lontra longicaudis (Olfers, 1818)

New records. EL SALVADOR • 3 specimens, sex undetermined; department of Santa Ana, Lempa hydrographic basin, Metapán municipality, Río Angue; 14°20.40'N, 089°33.50'W; 460 m a.s.l.; 4 Apr. 2019; individuals playing, one of them feeding on *Anableps dowei* (Gill, 1861) fish (Fig. 2). • 3 specimens, sex undetermined; department of Santa Ana, Lempa hydrographic basin, Metapán municipality, Río Angue; 14°20.40'N, 089°33.50'W; 460 m a.s.l.; 17 May 2019; individuals feeding on fish and crabs (Fig. 3). • 1 feces; department of Santa Ana, Lempa hydrographic basin, Metapán municipality, Río Angue; 14°20.40'N, 089°33.50'W; 460 m a.s.l.; 2 Jul. 2019; feces found on a rock (Fig. 4A). • 1 feces; department of Morazán, Lempa hydrographic basin, Arambala municipality, Río Sapo; 13°55.78'N, 088°5.98'W; 670 m a.s.l.; 20 Sep. 2019; feces found on a sandbank (Fig. 4B). • 1 feces; department of Morazán, Lempa hydrographic basin, Perquín municipality, Río Negro; 13°59.43'N, 088°7.94'W; 985 m a.s.l.; 1 Dec. 2019; feces found on a rock (Fig. 4C). • 1 feces; department of Morazán, Lempa hydrographic basin, Perquín municipality, Quebrada de Perquín; 13°57.36'N, 088°8.69'W; 1050 m a.s.l.; 15 Dec. 2019; feces found on a rock (Fig. 4D). • 1 ♂;

department of Usulután, Lempa hydrographic basin, Estanzuelas municipality; 13°39.92'N, 088°30.73'W; 86 m a.s.l.; 2004; specimen captured and housed in the National Zoological Park where it died years later. • 1 ♂; department of San Salvador, Lempa hydrographic basin, El País municipal; 14°01.73'N, 089°09.21'W; 260 m a.s.l.; 17 Jan. 2018; individual rescued by the Ministry of the Environment and Natural Resources. • Several individuals; department of Sonsonate, Grande de Sonsonate-Banderas hydrographic basin, Río Quequesquillo; 13°42.57'N, 089°42.58'W; 230 m a.s.l.; 9 Jul 2013; individuals observed swimming and recorded for local television (Sosa 2013).

We observed six new records in four locations from our field campaigns in 2019. From our review of other sources of information, we found three previously reported records from three other locations which were from governmental sources and a news item for television (Sosa 2013). We verified these records using available evidence, such as photographs of specimens. From our review of the scientific literature, we found five localities, and from our review of the UCLA mammal collection, two localities were found (Appendix 1). Thus,



Figure 2. Neotropical Otter (*Lontra longicaudis*) in Río Angue, April 2019.

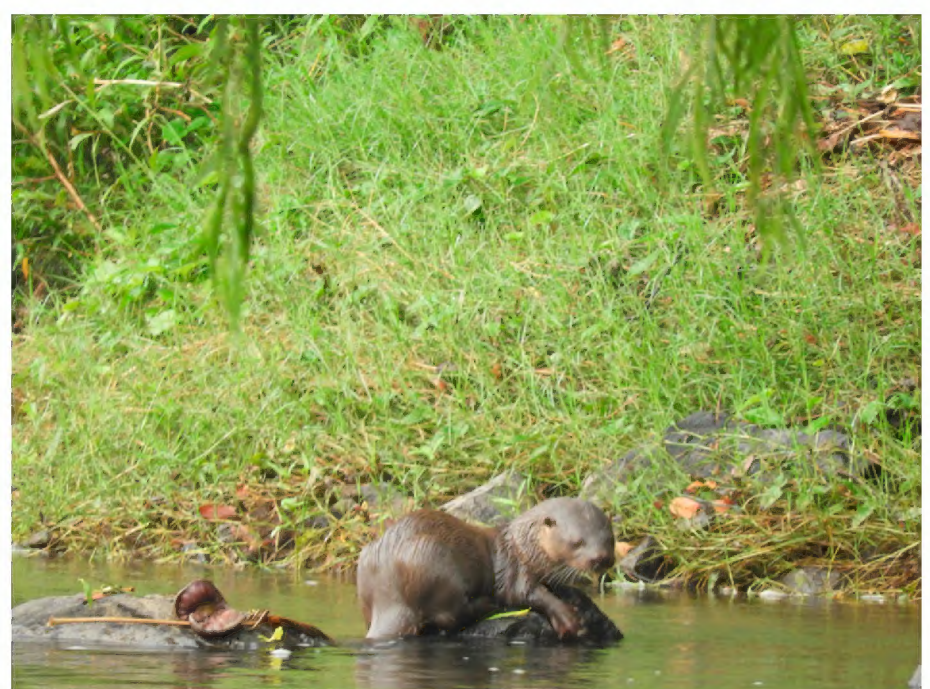


Figure 3. Neotropical Otter (*Lontra longicaudis*) in Río Angue, May 2019.

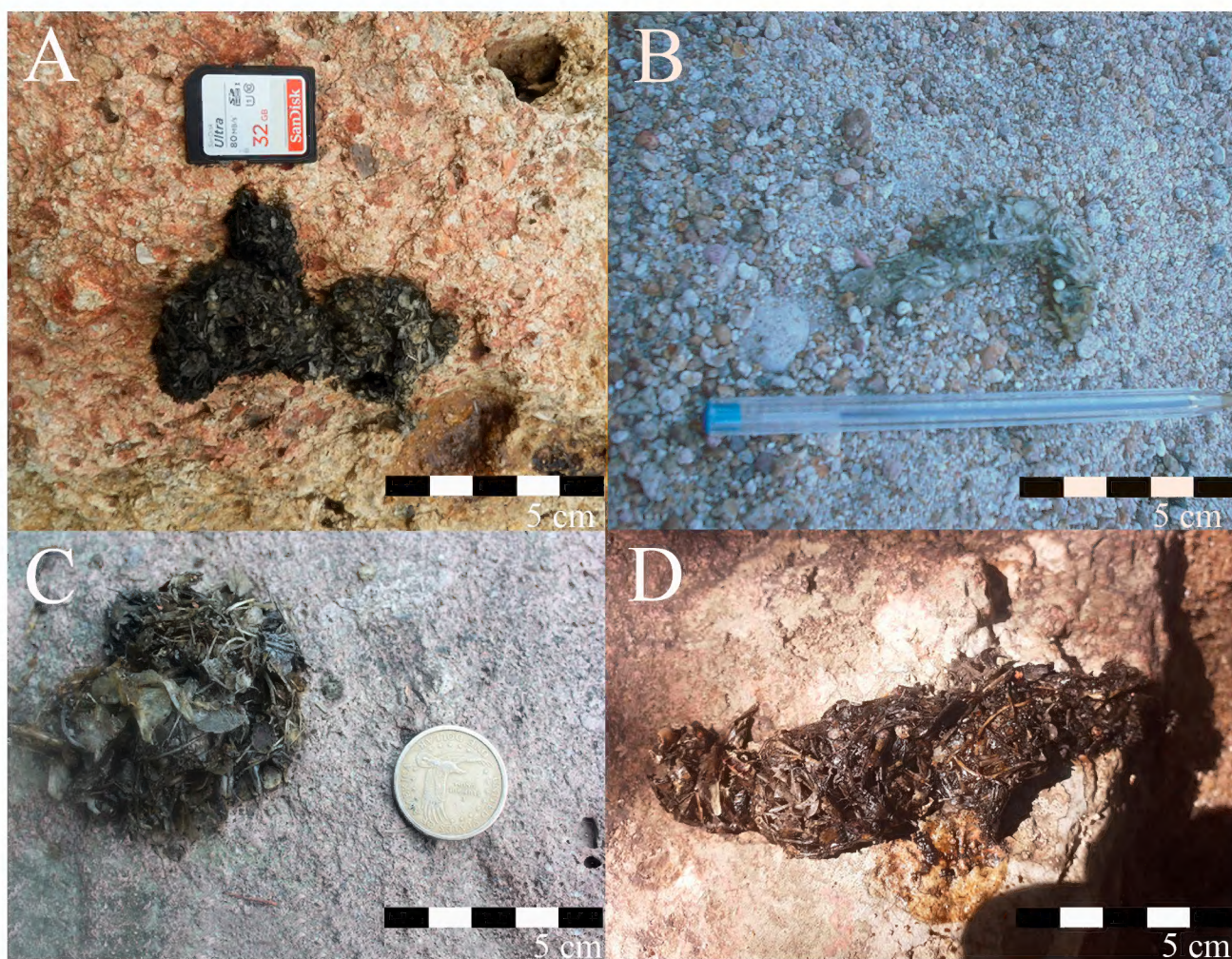


Figure 4. Feces of Neotropical Otter (*Lontra longicaudis*). **A.** Río Angue. **B.** Río Sapo. **C.** Río Negro. **D.** Quebrada de Perquín.

we found 14 localities occupied by *L. longicaudis* in El Salvador. Eleven records are from the Lempa hydrographic region, two from the Grande de Sonsonate-Banderas hydrographic region, and only one from the Cara Sucia-San Pedro hydrographic region. None of the records in this study are from protected natural areas, and only three records are from near any of these areas (Río Angue, El Paísna, Río La Palma) (Fig. 1).

Identification. We identified *L. longicaudis* by the morphological characteristics of a semi-aquatic mammal: uniform dark brown coloration on its dorsal part and slightly lighter on its ventral part, long tail, webbed feet, and short ears (Kruuk 2006). The feces of this species are very conspicuous, cylindrical, and easily identifiable by their odor; they contain fish scales and crustacean remains. Feces are found on prominent rocks, sandbars, or logs along riverbanks (Aranda 2000; Kruuk 2006).

Discussion

Our results, which includes 14 localities, include all known distribution records of *Lontra longicaudis* in El Salvador. There are four historical records with specimens in museums: two are previously published records collected in 1942 (Burt and Stirton 1961; Owen et al. 1991, Owen and Girón 2012), and two are unpublished records collected in 1927. Owen and Girón (2012) recently reported two sites in the departments of Ahuachapán and Morazán, and Argueta-Rivera et al. (2020) documented a new site in Morazán department. Our observations of individuals in Río Angue consisted of one female with her two cubs. Family groups generally consist of females with up to five cubs. Males are solitary (Kruuk 2006).

In Río Angue, *Lontra longicaudis* was observed eating an individual of *Anableps dowei*. Furthermore,

fishermen mentioned the occurrence of fishes such as *Rhamdia laticauda* (Kner, 1858), *R. guatemalensis* (Günther, 1864), *Oreochromis niloticus* (Linnaeus, 1758), *Parachromis motaguensis* (Günther, 1867), and *Amatitlania nigrofasciata* (Günther, 1867), common species and widely distributed in El Salvador (McMahan et al. 2013; Álvarez et al. 2017; González-Murcia et al. 2019), and potential prey species for *L. longicaudis* in this river. In Río Sapo, Río Negro, and Quebrada de Perquín, feces were found with the presence of fish scales. It is probable that *L. longicaudis* feeds on species such as *P. motaguensis*, one of the largest and most abundant fishes in these rivers (20–30 cm standard length; Francisco S. Álvarez pers. comm. 2019) or small fishes of the families Poeciliidae or Profundulidae, which are also found in these rivers (González-Murcia et al. 2019).

The Río Lempa hydrographic region contains the most occurrences of *L. longicaudis* (Fig. 1). This hydrographic region has the potential to interconnect many river networks because it includes more than half of El Salvador. Unfortunately, most rivers in this basin, as well as other rivers in the country, are polluted (MARN 2019). For example, a newspaper reported the chemical discharge that caused the death of many fishes and crabs in Río Quequesquillo (Salguero 2013) where only a few days prior locals saw *L. longicaudis* (Sosa 2013). This type of pollution alters aquatic ecosystems by degrading water quality and limiting food resources on which *L. longicaudis* depends on to survive (Reynoso 1997; Casariego-Madorell et al. 2008). Poor habitat quality in rivers might be the main reason that sightings of this species in El Salvador are few in just a few rivers.

Most occurrences of *L. longicaudis* are outside protected natural areas, and very few are close to these areas (Fig. 1). Some technical reports have included this

species in some protected areas (e.g., El Imposible, Santa Rita, Zanjón El Chino, and Barra de Santiago; Ramos and Salazar 2017), but there is no verifiable evidence in support of these reports. Therefore, the presence of this species needs to be confirmed by new studies.

Although there is no consensus, some authors have suggested that a Neotropical Otter individual has a home range that includes just a few kilometers (2–3 km) or large river sections (18–40+ km) (Nakano-Oliveira et al. 2004; Rosas 2004; Kruuk 2006; Trinca et al 2013). In this context, it is likely that protected areas of El Salvador may harbor only a few individuals and not large populations of *L. longicaudis* because these areas include only small extensions of rivers. Therefore, the existing protected natural areas are probably insufficient for the conservation of this species. Similar problems have been identified for many other carnivores in El Salvador (Crespin and García-Villalta 2014). The lack of suitable conditions (abundant food sources and vegetation) between populations may cause genetic isolation of these populations (Larivière 1999; Kruuk 2006). Future conservation strategies for this species should ensure good water quality and connectivity between rivers and forests.

Río Sapo has records from various years (Owen and Girón 2012; Argueta-Rivera et al. 2020) and in different sectors (middle and low basin). It is possibly that low human disturbance in this river has benefited this species, supporting the management and conservation proposals for this area, as suggested by Argueta-Rivera et al. (2020) and Morales-Rivas et al. (2020).

Our research is the first effort to compile verifiable occurrence data of *L. longicaudis* in El Salvador, but there are still knowledge gaps in the distribution of this species. It is possible that the elusive and solitary behavior of this species makes it difficult to study and detect (Rosas 2004; Pocasangre-Orellana and Spínola-Paralada 2018). Future efforts should continue to add occurrence data of this species in El Salvador, but also, they must consider things which will help to establish conservation guidelines for this species: how far can this species travel? What is the home range? How is the health of the populations? Are populations genetically stable? How many individuals are there per km²? Radiotelemetry, GPS tracking, genetic analyses, and deeper ecological studies will be important. These techniques could help focus efforts on the management and conservation of priority areas for the conservation of *L. longicaudis* in El Salvador.

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Authors' Contributions

Both authors wrote the manuscript, coordinated the fieldwork and sampling design, and reviewed the manuscript.

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Appendix

Summary of previous, verified records of *Lontra longicaudis* in El Salvador

Records. EL SALVADOR • department of Chalatenango, Lempa hydrographic basin, Los Esesmiles; 14°16.98'N, 089°07.01'W; 1400 m a.s.l.; 1927; UCLA: Mammals: 12577. • department of Chalatenango, Lempa hydrographic basin, Los Esesmiles; 14°16.89'N, 89°06.97'W; 1360 m a.s.l.; 1927; UCLA: Mammals: 12578. • department of Sonsonate, Grande de Sonsonate-Banderas hydrographic basin, Río Sensunapán; 13°35.98'N, 089°50.26'W; 6 m a.s.l.; 1942; MVZ 98285 (Burt and Stirton 1961; Owen et al. 1991). • department of La Libertad,

Lempa hydrographic basin, Río Sucio; 13°47.49'N, 089°25.52'W; 454 m.a.s.l.; 1942; MVZ 98286 (Burt and Stirton 1961; Owen et al. 1991; Owen and Girón 2012). • department of Ahuachapán, Cara Sucia-San Pedro hydrographic basin, Río La Palma; 13°47.39'N, 090°02.56'W; 15 m a.s.l.; 2012 (Owen and Girón 2012). • department of

Morazán, Lempa hydrographic basin, Arambala municipality, Río Sapo; 13°55.28'N, 088°06.32'W; 658 m a.s.l.; 2012 (Owen and Girón 2012). • department of Morazán, Lempa hydrographic basin, Arambala municipality, Río Sapo; 13°51.88'N, 088°05.55'W; 397 m a.s.l. (Argueta et al. 2020).